Remarks

Drawings

1. The drawings were objected to for failing to show "bandgap of the substrate" and "layers of the device".

While structural details essential for the proper understanding of the invention should be shown in the drawings (MPEP 608.02 (d)), it is respectfully submitted that it is not necessary for a proper understanding of the invention that the "bandgap" be visually depicted. Bandgap is a commonly known concept in chemistry which relates to the energy levels of the electrons in a particular chemical element. Thus, for example, silicon will have a specific bandgap or energy requirement for exciting its electrons. Page 3, lines 18-19 mentions that in the case of silicon the bandgap is 1.1 eV. Similarly, the bandgaps for the other chemical elements are known and are unique to each element. The bandgap of silicon is therefore a unique property of silicon, just as the atomic structure of silicon is unique, and therefore need not be shown on a picture for an understanding of the invention.

As regards, the "layers of the device", it is common knowledge that integrated circuits are created in steps involving the deposition of layers of material and the selective etching away of material. IC's are by their very nature created in layers. Page 2, lines8-9 emphasizes this by pointing out that prior to completion of the IC only some of these layers may have been deposited. Also, page 3, lines 7-8 points out that the number and nature of the layers of an IC may vary from one device to the next. One such layer is the metal layer 28 mentioned on page 3, lines 4-5. It is, therefore, respectfully submitted that the layers are illustrated (e.g. metal layer 28 in figure 1) and furthermore that layers are commonly used in the art and the use of the term "layers of the device" would be clear to someone skilled in the art.

2. The applicant thanks the examiner for proceeding with the informal drawings and will submit formal drawings at the time of allowance.

35 USC 112

Claims 3-8, 13 and 17 were rejected under 35 USC 112 as containing subject matter not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. In this regard, reference is again made to the term "bandgap of the substrate". The examiner is respectfully referred to the explanation above which

makes it clear that bandgap is a commonly understood concept in chemistry and is therefore a term that a person in the art will readily understand as referring to an inherent energy parameter of the substrate used. Page 3, lines 18-21 makes it clear that silicon has a bandgap energy of 1.1eV and that a laser beam is therefore used having this energy level or one just less than 1.1 eV. It is therefore respectfully submitted that the term "bandgap of the substrate" would be readily understood by someone skilled in the art of IC processing.

35 USC 102

6. Claims 1-2 were rejected under 35 USC 102 (b) as being anticipated by Henley. Claims 1 and 2 of the present application deal with of testing ESD performance of an IC device. Henley, on the other hand, serves to detect defects in the pixels of an active matrix Liquid Crystal Dispalys (LCDs) (Last 3 lines of Abstract, and first 4 lines of Summary of the Invention). In fact the entire Henley patent deals specifically with determining defects in LCDs. Nothing in Henley teaches or even suggests using the reflections from a laser beam to determine the electrostatic discharge (ESD) performance of an IC. There is also nothing inherent in the Henley approach that would provide information about the resilience of an IC device to electrostatic discharge.

It is therefore respectfully submitted that Henley does not teach or suggest the invention defined in claims 1-2 of the present invention.

7. Claims 3-20 were rejected under 35 USC 103(a) as being unpatentable over Henley in view of Livengood '746.

Claim 3 is dependent from claim 1 and therefore includes the limitations of claim which specifies that the claim involves the testing of the ESD performance of an IC device. Neither Henley nor Livengood disclose or suggest the testing of the ESD performance of an IC device.

Furthermore, it is respectfully submitted that Livengood does not mention using a laser beam that corresponds substantially to the bandgap of the substrate. Livengood (col 7, lines 46-57) mentions the use of an infrared laser beam to probe through the back side of a silicon semiconductor substrate but does not mention the energy level as corresponding substantially to the bandgap of the substrate. However, it refers to application Serial No. 08/766,149 which mentions the bandgap energy. The '149 application was filed by Paniccia et.al. and subsequently issued as 5,872,360 and will be referred to as the Paniccia

patent. An information disclosure statement is being filed herewith referencing the Paniccia patent to include the reference as part of the record and to allow the present application to be distinguished over Paniccia.

Paniccia deals with the focusing of a laser beam on an active region of a semiconductor in order to determine the electric field and thus the voltage at the diffusion. As is clear from a reading of the Description of the Related Art, especially the fourth paragraph, the purpose of the Paniccia approach is to debug semiconductor devices, especially C4 or flip chip devices. Thus Paniccia specifically looks at junction **voltages** by monitoring modulations in the reflected light. As stated on col. 6, lines 33-37, "The modulation of the photo-absorption of the laser beam 609 depends on the modulation of the electric field applied at the junction. This modulation in the absorption of the laser beam is the signal of interest since it is related to the voltage applied to the junction."

Livengood also makes it clear that its purpose is to probe integrated circuits to determine input and output signals (par.4, lines18-26).

As mentioned above, Henley deals specifically with detecting defects in the pixels of an active matrix Liquid Crystal Display.

In contrast, the present application does not involve itself with probing voltage or I/O signal levels or detecting defective pixels. Instead, it adopts an entirely new approach to determining the resilience of IC devices to electrostatic discharges. It has been found that the extent to which laser light is absorbed is related to the ESD resilience of the device. Thus by monitoring the amount of light reflected, a device with poor ESD performance can be distinguished from one with good ESD performance (page 4, lines 10-31).

Neither Henley, nor Livengood, nor Paniccia disclose or suggest a method of determining the resilience of an IC device to electrostatic discharge, nor does any of the data gathered by these references inherently disclose ESD performance.

Claim 4 is dependent from claim 3 and incorporates the limitations of claim 3. Claim 4 is therefore also distinguishable over the Henley, Livengood and Paniccia. It is respectfully submitted that 1.1 eV is not a standard range of any laser beam. The 1.1 eV is chosen specifically since the bandgap energy for silicon is 1.1 eV (page 3, lines 18-19).

Claims 5-7 are also dependent from claim 3 and incorporate the limitations of claim 3. Claims 5-7 are therefore also distinguishable over the Henley, Livengood and Paniccia.

Claim 8 is dependent from claim 3 and incorporates the limitations of claim 3. Claim 8 is therefore also distinguishable over the Henley, Livengood and Paniccia. Furthermore, Livengood does not disclose several samples being taken at each probed location. The regions 403, 411, 413 mentioned in Livengood refer to different diffusions as is clear from paragraph 7, lines 35-37. There is no teaching or suggestion that any one of those locations are sampled several times and the results averaged.

Claims 9-12 and 17-20 are also dependent from claim 3 and incorporate the limitations of claim 3. They are therefore also distinguishable over the Henley, Livengood and Paniccia. Furthermore, Henley does not disclose a continuous laser in addition to a mode-locked laser. A mode-locked laser (or pulsed laser – see page 4, lines 4-5) and a continuous laser are two different types of lasers, and in the present application, the continuous laser is used to position the mode-locked laser. In contrast, Henley does not specify what type of laser it uses, but it is clear that Henley does not make use of two lasers. As is clear from Figure 1 and column 3, line 55 – column 4, line 5, the only light source is light source 1. Reference numeral 3 refers to a light detector. Thus if the light source 1 is a mode-locked laser, detector 3 will detect the reflected light from this mode locked laser. If the light source 1 is a continuous laser, detector 3 will detect the reflected light from this continuous laser.
Claims 11 and 12 have been amended to depend from claim 9 instead of claim 10.
Claims 19 and 20 have been amended to depend from claim 17 instead of claim 18.

Claims 13-16 are dependent from claim 3 and incorporate the limitations of claim 3. They are therefore also distinguishable over the Henley, Livengood and Paniccia. Furthermore, claim 13 specifies that power is supplied **during testing**. Thus the power is not supplied merely to make the device operate but rather to test the device under powered conditions as opposed to testing the unpowered device.

It is respectfully submitted that Woodard and Tora-Lira also do not deal with methods of testing electrostatic discharge performance of an IC device. Tora-Lira , like Henley, deals with determining pixel conditions in a flat panel display. Woodard deals with electron beam testing of electronic components and mentions neither the use of a laser, nor the determination of electrostatic discharge resilience of an IC device.

It is respectfully submitted that none of the references teach or suggest a method of determining the electrostatic discharge performance of IC devices using a laser.

It is therefore respectfully submitted that all of the claims in the specification are patentably distinct over the prior art and that none of the prior art cited teaches or suggests the invention defined in any of the claims. It is therefore respectfully requested that the claims as amended be allowed.

Version with markings to show changes made:

11. (Amended) A method of Claim 9 [10], wherein the mode-locked laser is positioned by a user.

12. (Amended) A method of Claim 9 [10], wherein the mode-locked laser is positioned automatically using image recognition.

19. (Amended) A method of Claim 17 [18], wherein the mode-locked laser is positioned by a user.

20. (Amended) A method of Claim 17 [18], wherein the mode-locked laser is positioned automatically using image recognition.

Respectfully Submitted,

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Jurgen K. Vollrath

Vollrath & Associates
1222 Settle Ave.
San Jose, CA
Telephone: (408) 813 2141